1. WORK PLAN AND METHODOLOGY

THE MUSIC ALGORITHM

The main aim is to implement Direction of Arrival (DoA) algorithm called *MUSIC*. The goal of this work is to give a brief overview on smart antennas, before implementing some popular algorithms from this domain in MATLAB and providing simulation results, in order to enhance understanding of the possibilities, but also the limitations of these algorithms.

Multiple Signal Classification (MUSIC) is an algorithm used for frequency estimation and emitter location. MUSIC estimates the frequency content of signal or autocorrelation matrix using an Eigen space method. This method assumes that signal x(n) consist of p complex exponentials in presence of Gaussian White Noise. Given an M*M autocorrelation matrix, R, if the Eigen values are sorted in decreasing order ,the p eigenvector corresponding to p largest Eigen values spanning the signal sub space.

We have seen that for some beam formers, but also for other applications, it can be useful to gather information about the users' positions. Methods which extract this information from the incoming signals are called Direction of Arrival (DoA) Estimation Methods.

There are mainly two categories of such methods. The methods of the first one are called Spectral Estimation Methods. They include the MVDR (Minimum Variance Distortion less Response) Estimator, Linear prediction method, MEM (Maximum Entropy Method), MLM (Maximum Likelihood Method). The second category is formed by the Eigen structure Methods. They include the MUSIC (Multiple Signal Classification) algorithm, the Min-Norm Method, the CLOSEST Method, the ES-PRIT (Estimation of Signal Parameters Via Rotational Invariance Technique) algorithm, and others. There are some more methods that do not fit in any of these two categories.

A. Description

Adaptive algorithms are of three categories-

1.DoA based algorithm
2.Training sequence based algorithm
3.Blind beam forming algorithm

DoA algorithm are classified as-
1.MUSIC
2.ESPRIT
3.ML

In this work we will work for MUSIC algorithm. The flow chart of MUSIC algorithm is as shown above in figure 3. The flow starts from input signal of antenna and thus forms a covariance matrix R_{UU}, which is the second block of flow chart. The MATLAB is used for the above processing and for plotting MUSIC spectrum. MUSIC spectrum gives all idea of signal and thus gives direction arrival of signal for which it is intended to work.

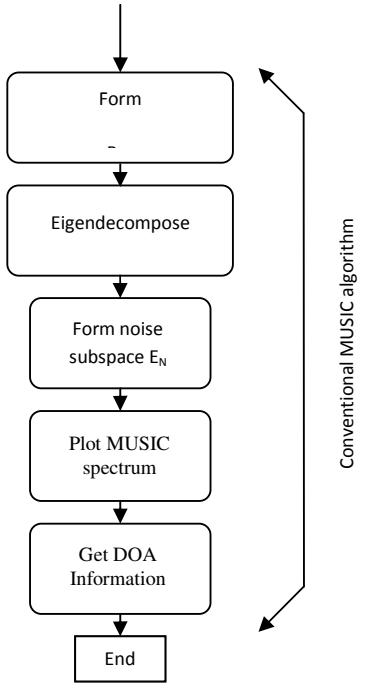

Fig. 2:- Flowchart of MUSIC Algorithm.